

FILEID**OTSPOWCGJ

K 10

000000 TTTTTTTTTT SSSSSSSS PPPPPPPP 000000 WW WW CCCCCCCC GGGGGGGG
000000 TTTTTTTTTT SSSSSSSS PPPPPPPP 000000 WW WW CCCCCCCC GGGGGGGG JJ
00 00 TT SS PP PP 00 00 WW WW CC GG JJ
00 00 TT SS PP PP 00 00 WW WW CC GG JJ
00 00 TT SS PP PP 00 00 WW WW CC GG JJ
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00 00 TT SS PP PP 00 00 WW WW CC GG JJ
000000 TT SSSSSSSS PP 000000 WW WW CCCCCCCC GGGGGG JJJJJJ JJ
000000 TT SSSSSSSS PP 000000 WW WW CCCCCCCC GGGGGG JJJJJJ JJ
.....

LL IIIII SSSSSSSS
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01
1-

(2)	47	HISTORY : Detailed Current Edit History
(3)	56	DECLARATIONS
(4)	90	OTSSPOWCGJ_R3 - G COMPLEX*16 ** INTEGER*4

0000 1 .TITLE OTSSPOWCGJ - G COMPLEX*16 ** INTEGER*4 power routine
0000 2 .IDENT /1-003/ ; File OTSPOWCGJ.MAR Edit: SBL1003
0000 3 *****
0000 4 *****
0000 5 *
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0000 23 *
0000 24 *
0000 25 *****
0000 26
0000 27
0000 28
0000 29 FACILITY: Language support library - user callable
0000 30 ++
0000 31 ABSTRACT:
0000 32
0000 33 G COMPLEX*16 base to INTEGER*4 power.
0000 34 Floating overflow can occur.
0000 35 Undefined exponentiation can occur if
0000 36 base = (0.,0.) and exp <=0
0000 37
0000 38 --
0000 39
0000 40 VERSION: 1
0000 41
0000 42 HISTORY:
0000 43 AUTHOR:
0000 44 Steven B. Lionel, 27-July-1979
0000 45

OTSSPOWCGJ
1-003

N 10
- G COMPLEX*16 ** INTEGER*4 power routin 16-SEP-1984 01:56:33 VAX/VMS Macro V04-00
HISTORY ; Detailed Current Edit History 6-SEP-1984 11:27:56 [MTHRTL.SRC]OTSSPOWCGJ.MAR;1 Page 2
(2)

0000 47 .SBTTL HISTORY ; Detailed Current Edit History
0000 48
0000 49
0000 50 : Edit History
0000 51 : 1-001 - Adapted from OTSSPOWCGJ version 1-003. SBL 27-July-1979
0000 52 : 1-002 - Fix bug in test for undefined exponentiation with negative powers.
0000 53 : SPR 11-35362 SBL 22-Jan-1981
0000 54 : 1-003 - Use general mode addressing. SBL 30-Nov-1981

```
0000 56      .SBttl DECLARATIONS
0000 57
0000 58 : INCLUDE FILES:
0000 59 : MTH$SIGNAL
0000 60 :
0000 61
0000 62 : EXTERNAL SYMBOLS:
0000 63 :
0000 64
0000 65     .DSABL GBL
0000 66     .EXTRN MTH$SIGNAL
0000 67     .EXTRN OTSSDIVCG R3      ; Math error routine
0000 68     .EXTRN MTH$K_UNDEXP    ; COMPLEX division routine
0000 69
0000 70 : MACROS:
0000 71 :
0000 72 :
0000 73
0000 74 : EQUATED SYMBOLS:
0000 75 :
0000 76 :
0000 77
0000 78 : OWN STORAGE:
0000 79 :
0000 80 :
0000 81
0000 82 : PSECT DECLARATIONS:
0000 83 :
0000 84 :
0000 85
00000000 86     .PSECT _OTSSCODE PIC,SHR,LONG,EXE,NOWRT
0000 87           ; program section for OTSS$ code
0000 88
```

0000 90 .SBTTL OTSSPOWCGJ_R3 - G COMPLEX*16 ** INTEGER*4
0000 91 ++
0000 92 FUNCTIONAL DESCRIPTION:
0000 93
0000 94 G COMPLEX*16 result = G COMPLEX*16 base ** INTEGER*4 exponent
0000 95 The COMPLEX result is given by:
0000 96
0000 97 base exponent result
0000 98 any >0 PRODUCT (base * 2**i) where
0000 100 i is each non-zero bit in
0000 101 exponent.
0000 102
0000 103 (0., 0.) <=0 Undefined exponentiation.
0000 104
0000 105 not (0., 0.) <0 PRODUCT (base * 2**i) where
0000 106 i is each non-zero bit in
0000 107 exponent!.
0000 108
0000 109 not (0., 0.) =0 (1.0, 0.0)
0000 110
0000 111 Floating overflow can occur.
0000 112 Undefined exponentiation occurs if base is 0 and
0000 113 exponent is 0 or negative.
0000 114
0000 115 CALLING SEQUENCE:
0000 116
0000 117 result.wgc.v = OTSSPOWCGJ_R3 (base.rgc.v, exponent.rl.v)
0000 118
0000 119 INPUT PARAMETERS:
0000 120 base = 4 ; G COMPLEX*16 base passed by VALUE!
0000 121 exponent = 20 ; Longword integer exponent by value.
0000 122
0000 123 IMPLICIT INPUTS:
0000 124 NONE
0000 125
0000 126 OUTPUT PARAMETERS:
0000 127 NONE
0000 128
0000 129 IMPLICIT OUTPUTS:
0000 130 NONE
0000 131
0000 132 FUNCTION VALUE:
0000 133
0000 134 THE G COMPLEX*16 result is returned in registers R0-R3.
0000 135 This is a violation of the VAX calling standard, but is
0000 136 excused for compiled code support routines.
0000 137
0000 138
0000 139 SIDE EFFECTS:
0000 140
0000 141 Modifies registers R0-R3!
0000 142 SSS FLTOVF - Floating overflow
0000 143 SIGNALS MTHS UNDEXP (82 = 'UNDEFINED EXPONENTATION') if
0000 144 base is 0 and exponent is 0 or negative.
0000 145
0000 146 --

```

      01F0 0000 148 .ENTRY OTSSPOWCGJ_R3, ^M<R4,R5,R6,R7,R8>
      0002 149 ; disable integer overflow
      7D 0002 150 ; R4-R7 gets COMPLEX base
      0C AC 7D 0006 151 MOVQ base(AP), R4
      14 AC DO 000A 152 MOVQ base+8(AP), R6
      03 18 000E 153 MOVL exponent(AP), R8
      58 58 CE 0010 154 BGEQ 1$ R8, R8
      00 E5 0013 155 1$: MNEGL #0, R8, EVEN
      58 54 50FD 0017 156 BBCC #0, R8, EVEN
      52 56 50FD 001B 157 MOVG R4, R0
      FF 8F 9C 001F 158 ROTL #-1, R8, R8
      58 6C 13 0024 159 BEQL DONE
      30 11 0026 160 BRB SQUAR1
      0028 161 ; R8 = unsigned_exponent / 2
      0028 162 EVEN: ; done if exponent was 1
      0028 163 ; else use rest of exponent
      08 50FD 0028 163 MOVG #1, R0
      52 7C 002C 164 CLRQ R2
      FF 8F 9C 002E 165 ROTL #-1, R8, R8
      23 12 0033 166 BNEQ SQUAR1
      53FD 0035 167 TSTG R4
      53 12 0038 168 BNEQ DONE
      53FD 003A 169 TSTG R6
      12 003D 170 BNEQ DONE
      003F 171 ; it isn't return 1.0

      003F 172 UNDEFINED:
      01 OF 79 003F 173 ASHQ #15, #1, R0
      01 OF 79 0043 174 ASHQ #15, #1, R2
      7E 00'8F 9A 0047 175 MOVZBL #MTH$K_UNDEXP, -(SP)
      00000000'GF 01 FB 004B 176 CALLS #1, G^MTH$$SIGNAL
      0052 177 ; convert to 32-bit condition code
      04 0052 178 RET
      0053 179 ; and SIGNAL MTH$_UNDEXP

      0053 180 SQUAR:
      58 58 FF 8F 78 0053 181 ASHL #-1, R8, R8
      0058 182 ; R8 = |reduced exponent| / 2
      0058 183 ; R4-R7 = square current base
      0058 184 ; SQUAR1:
      56 54 45FD 0058 185 MULG3 R4, R6, -(SP)
      54 54 44FD 005D 186 MULG2 R4, R4
      56 56 44FD 0061 187 MULG2 R6, R6
      54 56 42FD 0065 188 SUBG2 R6, R4
      56 8E 6E 41FD 0069 189 ADDG3 (SP), (SP)+, R6
      E2 58 E9 006E 190 BLBC R8, SQUAR
      0071 191 ; R6-R7 = 2*(RP(base)*IP(base))
      0071 192 ; branch if next exponent bit is 0
      0071 193 ; R0-R3 = partial result * current power of base
      0071 194 ; R0-R1 = RP(part) * IP(base)
      7E 56 50 45FD 0071 195 MULG3 R0, R6, -(SP)
      50 54 44FD 0076 196 MULG2 R4, R0
      7E 56 52 45FD 007A 197 MULG3 R2, R6, -(SP)
      50 8E 42FD 007F 198 SUBG2 (SP)+, R0
      52 54 44FD 0083 199 MULG2 R4, R2
      52 8E 40FD 0087 200 ADDG2 (SP)+, R2
      58 58 FF 8F 78 008B 201 ASHL #-1, R8, R8
      C6 12 0090 202 BNEQ SQUAR1
      0092 203 DONE: TSTL exponent(AP)
      14 AC D5 0092 204 ; test exponent sign

```

OTSSPOWCGJ
1-003

E 11
- G COMPLEX*16 ** INTEGER*4 power routin 16-SEP-1984 01:56:33 VAX/VMS Macro V04-00
OTSSPOWCGJ_R3 - G COMPLEX*16 ** INTEGER* 6-SEP-1984 11:27:56 [MTHRTL.SRC]OTSSPOWCGJ.MAR;1 Page 6 (5)

1D 18 0095 205 BGEQ POWCGJ ; done if positive
50 53FD 0097 206 TSTG R0 ; test RP(result)
05 12 009A 207 BNEQ RECIP ; if non-0, OK to take reciprocal
52 53FD 009C 208 TSTG R2 ; RP(result) was 0, test IP(result)
9E 13 009F 209 BEQL UNDEFINED ; undefined (0.0+0.0i) ** -n
00000000'GF 00A1 210 RECIP:
7E 52 7D 00A1 211 MOVQ R2, -(SP) ; second arg pair is divisor
7E 50 7D 00A4 212 MOVQ R0, -(SP)
7E 7C 00A7 213 CLRQ -(SP) ; push (1.0,0.0) on stack
7E 08 50FD 00A9 214 MOVG #1, -(SP)
08 FB 00AD 215 CALLS #8, G^OTSSDIVCG_R3 ; R0-R3 = reciprocal
00B4 216 POWCGJ: RET ; result in R0-R3
04 00B4 217
00B5 218
00B5 219 .END

BASE	=	00000004
DONE		00000092 R 01
EVEN		00000028 R 01
EXONENT	=	00000014
MTH\$SIGNAL	*****	X 00
MTH\$K UNDEXP	*****	X 00
OTSSDIVCG_R3	*****	X 00
OTSSPOWCGJ_R3	00000000 RG	01
POWCGJ	000000B4 R	01
RECIP	000000A1 R	01
SQUAR	00000053 R	01
SQUAR1	00000058 R	01
UNDEFINED	0000003F R	01

+-----+
! Psect synopsis !
+-----+

PSECT name	Allocation	PSECT No.	Attributes
-----	-----	-----	-----
. ABS	00000000	(0.) 00	NOPIC USR CON ABS LCL NOSHR NOEXE NORD NOWRT NOVEC BYTE
_OTSSCODE	000000B5	(181.) 01	PIC USR CON REL LCL SHR EXE RD NOWRT NOVEC LONG

+-----+
! Performance indicators !
+-----+

Phase	Page faults	CPU Time	Elapsed Time
-----	-----	-----	-----
Initialization	30	00:00:00.10	00:00:01.02
Command processing	108	00:00:00.48	00:00:02.73
Pass 1	75	00:00:00.65	00:00:02.91
Symbol table sort	0	00:00:00.01	00:00:00.01
Pass 2	52	00:00:00.51	00:00:02.52
Symbol table output	2	00:00:00.01	00:00:00.41
Psect synopsis output	2	00:00:00.03	00:00:00.06
Cross-reference output	0	00:00:00.00	00:00:00.00
Assembler run totals	271	00:00:01.81	00:00:09.75

The working set limit was 900 pages.

3177 bytes (7 pages) of virtual memory were used to buffer the intermediate code.

There were 10 pages of symbol table space allocated to hold 13 non-local and 1 local symbols.

219 source lines were read in Pass 1, producing 11 object records in Pass 2.

0 pages of virtual memory were used to define 0 macros.

+-----+
! Macro library statistics !
+-----+

Macro library name	Macros defined
-----	-----
\$_255\$DUA28:[SYSLIB]STARLET.MLB;2	0

0 GETS were required to define 0 macros.

There were no errors, warnings or information messages.

OTSSPOWCGJ
VAX-11 Macro Run Statistics

- G COMPLEX*16 ** INTEGER*4 power routin ^{G 11} 16-SEP-1984 01:56:33 VAX/VMS Macro V04-00
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(5)

MACRO/ENABLE=SUPPRESSION/DISABLE=(GLOBAL,TRACEBACK)/LIS=LIS\$:OTSSPOWCGJ/OBJ=OBJ\$:OTSSPOWCGJ MSRC\$:OTSSPOWCGJ/UPDATE=(ENH\$:OTSSPOWCGJ)

0264 AH-BT13A-SE
VAX/VMS V4.0

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